Journal of Mathematics and Statistics

Original Research Paper

Exploratory Analysis of Rainfall Occurrence in South Sulawesi Region Using Spatial Point Process

[1]Nurtiti Sunusi, [1]Erna Tri Herdiani, [1]Fachrul Nawawi, [2]Giarno

[1]Department of Mathematics, Faculty of Mathematics and Natural Sciences, Hasanuddin University, Indonesia
[2]Department of Meteorology, Climatology and Geophysics, Paotere, Makassar, Indonesia

Article history
Received: 16-06-2015
Revised: 26-10-2015
Accepted: 17-11-2015

Corresponding Author:
Nurtiti Sunusi,
Department of Mathematics,
Faculty of Mathematics and Natural Sciences, Hasanuddin University, Indonesia
Email: ntitisanusi@gmail.com

Abstract: This paper study the probability of rainfall occurrence in round year in different segment in South Sulawesi region. In this research, rainfall occurrence in round year described by one line which has divided into 12 months. Each one of those months is assumed that the probability of a rainfall follow a homogeneous Poisson distribution. To modeling the rainfall occurrence in round year, a spatial point process is used. The parameter of the model is estimated by Seemingly Unrelated Regression (SUR) method and Ordinary Least Square (OLS) method with assume that two stations have a correlation in residual model. Results of case study on monthly rainfall data indicate that when the residual correlation (autocorrelation) on all models is weakly and not significant. Thus, it has not good enough to use the SUR method for increase efficiency compared with the OLS method. Moreover, results of the parameter estimation of the model for two selected stations (Paotere and Mandai) showed that the SUR method is more representative than the OLS method.

Keywords: Spatial Point Process, Ordinary Least Square, Seemingly Unrelated Regression

Introduction

Forecasting is a science to predict events in the future which can be done by using past data into a mathematical model to predict the future of data. In forecasting, data that has dependencies on time is used. It was taken in a certain time within the same time interval. Furthermore, the influence of the location (space) is taken into account, or in this case knows as the space-time data. Data is measured against several observation sites, so in addition to having dependencies on time, the data space time also have dependencies on space. Rainfall phenomena are occurs in random and has dependencies on time. Spatial Point Process is a stochastic model that was built on the site of a phenomenon $\{S_i\}$ on the set X. One of the simplest models of point process is Poisson process. There is extensive literature on the use of Poisson cluster processes in the stochastic modeling of rainfall, stemming largely from (Rodriguez-Iturbe *et al*., 1987; Onof *et al*., 2000; Cameron *et al*., 2000). Rainfall modeling can generally be classified into four categories (Onof *et al*., 2000): (1) Meteorological models involving complex sets of differential equations representing the physical processes controlling precipitation and other weather variables; (2) stochastic multiscale models describing the spatial evolution of the rainfall process independently of scale; (3) statistical models which can allow for the modeling of trends; and (4) stochastic process.

Some previous researchers have done a study on parameter estimation of the model, among others (Alaba *et al*., 2010; Vasco, 2012; Atanlogun *et al*., 2014). Alaba *et al*. (2010) showed the efficiency of SUR method compared with OLS method. In other research, Vasco (2012) use SUR to predict the carcass composition of Lambs. Furthermore, Atanlogun *et al*. (2014) studied the comparison between OLS method and SUR method. The result of analysis shows that OLS and SUR methods have a standard error and coefficient value in simultaneous equation.

In recent years, the occurrence of rain in parts of Indonesia is difficult to predict because of the erratic appearance. Rainfall in parts of Indonesia almost evenly, but in some areas there is a difference in terms of the level/intensity of rainfall. Rainfall in Indonesia are generally within the normal range, but in several areas including South Sulawesi and surrounding areas, the rainfall will exceed the normal limits on certain months. Therefore, these phenomena can be modeled using a model point process which is reviewed based on the location that has the level of rainfall exceeds